

National Aeronautics and Space Administration
Commercial Space Committee
of the
NASA Advisory Council

AUGUST 2, 2011

AMES RESEARCH CENTER, MOFFETT FIELD CALIFORNIA

Meeting Minutes

John Emond Executive
Secretary Commercial Space
Committee

Bretton Alexander
Chair, Commercial Space Committee

*Meeting report prepared by
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John Emond opened the meeting at 8:30 am; it was open to the public under the Federal Advisory Committee Act/FACA guidelines.

Mr. Emond introduced Bretton Alexander, committee chair who extended greetings to those present.

Commercial Reusable Suborbital Research/CRuSR

The briefings to the Committee began with a presentation on Commercial Reusable Suborbital Research (CRuSR) by Dr. Laguduva “LK” Kubendran, Program Executive, Flight Opportunities within the Cross Cutting Capabilities Demonstration Division, Office of Chief Technologist. This briefing and others that followed, will be posted on the Office of Chief Technologist web site. Mr. Kubendran indicated the program is fostering technology development, scientific research and education, with a program emphasis on providing flight opportunities rather than payload development, which is supported by other programs inside and outside the Agency.

Questions and responses that emerged during the presentation are as follows:

Mr. Wilbur Trafton: How much of the \$15M identified in the budget is for payload development?

Dr. Kubendran: Only a couple million of the overall amount; the primary focus is on transportation.

Mr. Lon Levin: What is the cost for flight?

Dr. Kubendran: The cost varies for flight.

Mr. Levin: How many flights can be obtained with \$15M?

Dr. Kubendran: The flights could be as many as one per week (this includes parabolic aircraft flights).

Dr. Kubendran then described OCT’s structure of 10 programs and 3 Divisions including the flight opportunities program within the Cross-Cutting Capabilities Demonstration Division. The Office of Chief Technologist was established in FY 11. NASA Dryden is the lead center for the Flight Opportunities program. The program primarily engages commercial flight providers.

Mr. Levin expressed interest in the numbers that are associated with \$15M budgeted, and did not see as many commercial entities listed.

Dr. Kubendran indicated the Office of Chief Technologist was in the middle of a procurement for suborbital flights and payload integration support. The announcement of selection was anticipated to be released shortly. The intent is for multiple vendors selected to stimulate the demand side as well as the transportation capability side.

It should be noted that following this meeting, NASA announced on August 9 the contract awardees for suborbital flights:

- Armadillo Aerospace, Heath, Texas
- Near Space Corp., Tillamook, Ore.
- Masten Space Systems, Mojave, Calif.
- Up Aerospace Inc., Highlands Ranch, Colo.
- Virgin Galactic, Mojave, Calif.
- Whittinghill Aerospace LLC, Camarillo, Calif.
- XCOR, Mojave, Calif.

Mr. Alexander noted \$475K to two companies (Armadillo Aerospace and Masten) for 7 flights. *Mr. Kubendran* noted Armadillo decided to pull out of this contract and retire the flight vehicle due to a test flight incident where the vehicle was severely damaged. Given the subsequent announcement by NASA of awardees including Armadillo Aerospace, presumably the company will be flying a different vehicle.

Mr. Levin: Launchers and payloads: more information is needed on payloads; he was trying to understand commercial demand but did not see the demand. He wanted to see more information on a breakout between academic, government and commercial users including anticipated flight numbers.

Dr. Kubendran: Procurement is limited to the number of flights available on hand; 23 payload candidates were received by the February 2011 cutoff. About a dozen were received for the subsequent cutoff in June, 2011. The general breakout is roughly 1/3 each of academic, government, and commercial payload providers.

Mr. Alexander asked why would commercial entities go to NASA instead of directly contacting commercial transportation providers?

Dr. Kubendran indicated the commercial entity benefits by sponsored flight, but must also meet NASA mission requirements for such sponsorship.

Mr. Levin was interested in the non-NASA market.

Dr. Kubendran indicated there will be more clarity in flight numbers and payloads in about a year with a range of users such as NSF and NIH.

Mr. Alexander and Mr. Levin indicated industry demand absent government users would not provide a sufficient market; there also needs to be government payloads in basic research and technology development.

Ms. Patricia Grace-Smith asked about the evaluation criteria: experience of vendors?

Dr. Kubendran indicated prior experience with flying payloads is a positive factor in evaluation.

Ms. Smith inquired about sub-orbital payload licenses?

Dr. Kubendran indicated yes, licenses include indemnification protection for companies.

Dr. Bernard Harris inquired about the program budget/cost, \$17M annual for 3 years?
Dr. Kubendran affirmed those numbers which are primarily for procuring flight opportunities, and indicated the payloads will be from OCT (e.g., SBIR and other programs) and are solicited through Announcement of Flight Opportunities, and Research Opportunities in Space and Earth Sciences such as “ROSES” (peer-reviewed research opportunities within the Science Mission Directorate), etc.

Mr. Alexander noted only a few of the \$15M will go towards development of candidate payloads; most of the payloads to be paid by other sponsors.

Dr. Kubendran noted other Office of Chief Technologist divisions such as Game Changing Technology Division may also become involved to solicit payloads.

Mr. Alexander asked whether the limiting factor was transportation vehicles rather than payloads?

Dr. Kubendran indicated that the program is stimulating both supply and demand sides; half of the launch vehicle activity is expected to be generated through the Office of Chief Technologist “pipeline”; the other half of launch vehicle activity will come from other sectors.

Dr. James Reuther, Director, Office of Chief Technologist Cross-Cutting Division, noted there needs to be both payload demand and vehicle capability to have the flight activity become self-sustaining.

Mr. Alexander: Is the \$15 M identified, to be spent entirely this year?

Dr. Reuther: The Office of Chief Technologist Operations Plan was only approved a few days prior to the Committee meeting of August 2; solicitations could not go out until the Op Plan approval. This office needs to proceed wisely to obligate authorized funding without being reckless.

Mr. Kubendran: With the budget we have we can move out with the program.

Mr. Levin: The Committee needs to have numbers associated with success criteria; the approach is good but there needs to be success metrics.

Dr. Kubendran: Our office is targeting 30 payloads for FY 2011, 50 payloads for FY 2012 for parabolic and sub-orbital flight opportunities.

Mr. Levin: It looks like this is an effort to “prime the pump” for launch services by funding payloads, especially government payloads. What is the magnitude of the commercial user target?

Dr. Kubendran: Not a set target number of government, commercial etc., but a balance among the user communities.

Dr. Reuther: Lon is asking a question of target numbers.

Mr. Levin: I am trying to see how success is measured by target numbers.

Dr. Reuther: At this point there are no target figures yet but a metrics analysis is in process to develop such measurements. Part of the constraint has been the fluid budget environment.

Ms. Smith: I recognize that hard data is not yet clear on flight and payload numbers.

Dr. Kubendran: Flight demand will become clearer over time.

Mr. Alexander: Is the current solicitation part of the \$15M?

Dr. Kubendran: Yes. The contracts are fixed price for commercial services. Multiple awards with competition and frequency of flights driving the price down. Frequent flights will accelerate technology development. Longer range plans for orbital launch and rideshare opportunities could evolve from this program.

INNOVATIVE LUNAR DEMONSTRATION DATA OVERVIEW AND STATUS/ILDD

Mr. Nantel Suzuki, Program Executive, Innovative Lunar Demonstration Data Overview and Status/ILDD, gave the next presentation via VITS. Questions and responses are as follows:

Mr. Suzuki: There is a growing interest in a return to the Moon including privately funded activities such as Google Lunar X Prize. There is now a positive collaboration with the X-Prize Foundation for data purchase rather than acquisition of hardware: buying design data now, mission and performance data later. There are multiple aims in this program:

- Innovative acquisition approach while ensuring value to the Agency.
- Learning from a diverse set of entrepreneurial players engaged in lunar missions such as Lander technology, etc.
- Gives NASA an opportunity of a return to the Moon robotically through partnerships.

Though modest in scale, this is a leveraged mission which stimulates commercial sector involvement: delivery of cargo to the Moon; data derived from operations on the Moon. Multiple fixed price contracts, Indefinite Delivery/Indefinite Quantity with a potential total value of \$30M. Period of performance is up to 5 years. There were 6 ID/IQ contractors with ultimately 3 selected.

Ms. Smith: Foreign contractors?

Mr. Suzuki: None; foreign contractors could have responded but only U.S. contractors were ultimately selected. The performance period is 2010 through 2015. All contractors may bid on an element; 3 were selected for a particular element. In terms of data, it must be available for government use and proposers could offer broader data rights as part of the evaluation factor.

Dr. Harris: What kind of data is determined to be of value to NASA?

Mr. Suzuki: Early element, design data, goals and objectives, schedule, mission risks, etc.; hardware test data, structural test article.

Mr. Alexander: Is there a need to have already performed the activity in order to provide the information?

Mr. Suzuki: Yes. \$500K to each of 3 contractors to CLIN 1.

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Dr. Harris: The data will be made available to the government: what about the intellectual property (IP)? Will the IP distribution be the company's decision and discretion?

Mr. Suzuki: Yes; the companies responded to the level of data that will be provided to the government. Companies determined the sensitivity level of the data.

In terms of the ID/IQ contract size, companies responded to various elements of the solicitation: as little as \$10K, or as large as \$10M depending on what the company responded to. In August of 2010 there was a Broad Agency Announcement; six companies were awarded contracts and all happened to be Google Lunar X Prize competitors. The budget projection is for \$30M over 5 years but that will ultimately be based on the authorized budget. The program was originally out of the Constellation Lunar Lander program, but it is now part of the Exploration Systems Mission Directorate (now changed to Human Exploration and Operations as a result of the merger between Exploration Systems Mission Directorate and Space Operations Mission Directorate).

Mr. Alexander: What is the budget breakout challenge alluded to?

Mr. Suzuki: Taking the challenge on a CLIN by CLIN incremental basis; we want continuity based on available budget funding.

Mr. Alexander: 1.8M in FY 2012?

Mr. Suzuki: Yes; we can't be definitive but that that is the target; possibly adding another CLIN if the budget supports such an addition.

We are matching NASA's profile with the profile of the contractors. There are varying degrees of Lunar Lander configurations; details are in the public domain. This is an innovative activity to return to the moon and an innovative approach to obtain data through acquisition from external sources. It is a viable model for public/private partnership teaming; these entities may reach the Moon sooner than traditional spacecraft design efforts.

Mr. Trafton: Is there insight into private funding status/viability of the firms selected?

Mr. Suzuki: Criteria for selection was in part based on the business plan. The data delivery orders to obtain more update on a company's business viability status.

Mr. Trafton: Should a company happen to drop out, is there a backup/substitution?

Mr. Suzuki: We are not anticipating a dropout to occur.

Mr. Harris: How did this project get started?

Mr. Suzuki: Google Lunar X-Prize contacted NASA to explore potential partnership. NASA wanted to make sure there is a value for the agency.

Mr. Levin: What is the connection to the Lunar X-Prize?

Mr. Suzuki: This is independent of the Google Lunar X-Prize

Mr. Levin: The same entities who received the Google X-Prize are also recipients of the NASA Lunar Data Buy. There needs to be caution to avoid issues of government funding on one hand, and Google X-Prize on the other.

Mr. Suzuki: Collaboration between these two initiatives has been well received; the NASA Lunar Data Buy is complementary to the Google Lunar X-Prize.

HOSTED PAYLOADS

Dr. James Reuther, Acting Director, Crosscutting Capability Demonstration Division, provided an introduction to the Hosted Payloads presentation.

Dr. Reuther: There is in place a comprehensive strategy for suborbital payloads and flight opportunities. There is not yet one for orbital payloads and flight; such efforts are highly dependent on upcoming budgets.

Multiple programs can evolve under the Hosted Payloads program. Some missions will use dedicated launch vehicles; other missions may leverage flight access with other agencies and customers on a ride-share basis.

Given the complexity of options, the Crosscutting Capability Demonstration Division is just starting to communicate with launch providers, payload integrators, etc. We are looking for a person to fulfill this manifesting role within the Office of Chief Technologist.

Technology Demonstration Mission: In the next three months we will proceed to establish this program.

Mr. Levin: The budget is not the issue. The issue is development of a program with milestones and metrics, regardless of the specific budget profile.

Dr. Reuther: There can be an overview of the Flight Projects program within the Crosscutting Capability Demonstration Division as a briefing in the next Commercial Space Committee meeting.

Ms. Doreen Neil, physical scientist, NASA Langley Research Center, provided a briefing that highlighted a range of science missions including support to other agencies. There are 2 Decadal Survey missions to Geosynchronous orbit and ~6 technology missions to Geosynchronous orbit.

Mr. Levin: In terms of issues, are they not technical, but rather timing issues?

Ms. Neil: Yes. ~5 years to develop the payload the payload. A key milestone is Critical Design Review at which point there needs to be identification of the spacecraft to provide the transportation. She also noted that most scientific measurements are in Low Earth Orbit/LEO.

Dr. Harris: Shouldn't the 5 year timeframe for payload development be reduced?

Ms. Neil: 5 years is a measure of funding and schedule/process challenge including review processes such as design reviews.

Dr. Harris: The process needs to change to be more responsive.

Ms. Neil: We are linking up hardware development with science milestone reviews such as Critical Design Review. We are also working on minimizing the impact on payload

development, to keep the price low. We recognize that commercially hosted payloads also fit NASA goals.

Mr. Levin: Any resistance on other parts of NASA where a center may want to do this internally?

Ms. Neil: NASA Earth Science HQ has voiced high level support for the use of external sources.

Mr. Alexander: It would be an improvement to de-couple/educate the science program to not select 5 years in advance the vehicle to use.

Ms. Neil: For Earth Science we do not need to build a vehicle that can transit to Geosynchronous orbit, as most science missions only require transit to Low Earth Orbit.

Ms. Neil concluded with the recognition that Deputy Administrator Garver and Associate Administrator, Science Mission Directorate, are very supportive of hosted payloads.

RIDESHARE

Mr. Bruce Yost, Payload Operations Supervisor, Ames Research Center, provided an overview of the Rideshare program, defined as “Auxiliary add-on payload, not driving primary mission parameters.” Rideshare does not dictate mission parameters and cannot expose the primary payload to risk. Rideshare does not pay for the launch. All U.S. launch systems are capable of co-manifesting payloads. Many non-U.S. launch providers are also capable of co-manifesting payloads. Rideshare opportunities are becoming more available such as CUBESATS: relatively low cost while keeping any risk away from the primary mission.

This program is working with other entities for opportunities to break the cycle of increasing costs for space access.

Mr. Yost also described the EDISON program of small spacecraft, to exploit secondary payload opportunities at the subsystem, component level.

Mr. Alexander: Where is this launch services program?

Mr. Yost: Out of Ames Nanosat program; this program may be expanded to other programs to explore other potential users of this shared transportation approach, through Rideshare conferences and working groups.

Mr. Levin: Where is the interest coming from...payloads or launch service providers?

Mr. Yost: It is the payload community indicating an interest in more flight opportunities to space. United Launch Alliance is also looking at the Rideshare approach.

Mr. Levin: Is this program is supported, is there also a growing interest in payload standardization?

Mr. Yost: Yes, there is a growing area of interest.

COTS/COMMERCIAL RESUPPLY/COMMERCIAL CREW

This was a joint session of the Space Operations Committee, Exploration Committee, and Commercial Space Committee

Mr. Phil McAlister provided a briefing on the current status of CCDEV

Mr. Suffredini provided a status briefing on commercial resupply services

Mr. Lindenmoyer provided a status briefing on Commercial Orbital Transportation Systems

Resupply Services (CRS) & Commercial Crew

The NASA Commercial Space Committee joined the meeting for this presentation, which was given jointly by Mr. Phil McAlister of ESMD, Mr. Alan Lindenmoyer of JSC, and Mr. Michael Suffredini, also from JSC. Mr. Bretton Alexander, Chair of the Commercial Space Committee, observed that it was important to have the Committees meet together, as they have issues that have overlapped. His group has made some recommendations regarding commercial crew.

Mr. Lindenmoyer presented first, with a status update on COTS, including the latest information from Orbital Sciences Corporation (Orbital) and Space Exploration Technologies Corp. (SpaceX). Both are progressing well, though there have been some delays due to the typical development challenges. SpaceX successfully completed its first COTS demonstration mission in December, 2010, and has demonstration flights C2 and C3 scheduled for November 2011 and March 2012. The company asked NASA to consider combining the integration of cargo on the two missions, accelerating the C3 mission objectives (ISS berthing) on C2 flight. NASA has been studying the safety, reliability, and technical aspects of this proposal and is close to a formal approval. However, questions remain due to the SpaceX desire to do secondary payloads. Therefore, NASA is looking at the proposal more closely, and SpaceX is looking at changes that might mitigate risks. SpaceX will conduct the third flight regardless, so this is an opportunity to do berthing early. A successful C2 flight means that the C3 flight would have a “bonus” objective. NASA will assess how well the mission meets the total objective. The milestones are based on objective criteria; NASA has paid not for a certain number of rockets, but for the demonstration missions. The last payments are small.

SpaceX and Orbital must meet all of the NASA criteria, and NASA makes the decisions where there is a difference of opinion. Orbital is conducting integration of the Cygnus Service Module and the Taurus II launch vehicle. The latter has had problems with a fuel line during tests. The question is how to inspect these engines for flight. Therefore, Orbital is developing inspection and repair criteria in anticipation of a February 2012 ISS demonstration flight. The company will test to 100 percent and believes that at least one-third of the engines will pass the inspections and can be used as-is.

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For FY11, NASA received \$288 million in additional funding to reduce risks associated with the remaining development and timely demonstration of cargo space transportation capabilities. COTS determined that the best use of these funds is additional spacecraft-level testing for SpaceX. The company already does extensive component testing, which it prefers as a way of testing the entire system, and agreed to the spacecraft testing of systems that NASA prefers. Orbital spent most of its additional funds on another flight.

To date, SpaceX has completed 27 of 40 milestones, accounting for a total of \$313 million out of a total \$396 million in NASA payments. The second SpaceX flight will be much more complex than prior efforts, as the Dragon 2 spacecraft will have a cargo rack, Passive Common Berthing Mechanism (PCBM), claw, and solar array. SpaceX has tested the first stage and is fitting the second stage. The project is progressing through the milestones.

At Orbital, 23 of 29 milestones have been completed, for \$261.5 million in NASA payments out of the allocated \$288 million. The pressurized cargo module is ready to ship, Cygnus has been through avionics testing, the launch pad is under construction, and two launch vehicles are in the integration facility.

Discussion

Mr. Alexander asked if the December date for the first Taurus 2 maiden flight was date selected before the engine testing mishap. *Mr. Lindenmoyer* said that the original plan was for an October flight, but the change was driven primarily by turnover of the plan. The schedule does include slack for additional engine inspection, so that was not a factor.

Dr. Harris of the Commercial Space Committee asked how serious the engine failure was and whether it might be a system problem.

Mr. Lindenmoyer said it was serious. There was a detailed discussion of a mitigation plan, and NASA is confident that Orbital will conduct a full critical flaw site analysis on each engine. It will be at least the end of August before NASA knows if the mitigation techniques are acceptable. *Mr. Seffredini* explained that an experienced person from Marshall Space Flight Center (MSFC) is working on the project. This individual says that the repair technique has been used on Apollo and other programs, and he believes it will work in this situation as well. It is likely to have a minor schedule impact. Aerojet will do the repairs.

Mr. Trafton of the Commercial Space Committee asked if NASA was satisfied with SpaceX's Dragon splashdown and recovery. This was watched at the launch control center, and NASA was pleased with the results.

Mr. Suffredini, Manager of NASA's ISS Program, gave a CRS status update. His team is responsible for ensuring that commercial visiting vehicles to the ISS meet the required level of safety. While mission success is left to the individual visiting vehicle developers, there is a 4km by 2km by 2km approach sphere. No vehicle entering that sphere has

differing criteria. This is key to ensuring crew safety. A document called the SSP 50808 “ISS to Commercial Orbital Transportation (COTS) Interface Requirements Document (IRD)” spells out the interface requirements.

A plan was provided addressing requirements and the schedule. The integration status schedule for the Orbital demonstration flight, for example, shows 32 completed safety hazard reports. The Mission Planning and Integration process is proceeding well, with completion of Expedition 30 crew training for the commander, Dan Burbank, and the remaining crew about to be trained. The Horizontal Integration Facility (HIF) construction is complete. The Flight Operations Review (FOR) was scheduled for mid-September, launch pad turnover testing will occur at the end of October, to be followed by robotics crew trials.

A chart showing the integrated flow included the Orbital hot fire test in late November 2011 and the test flight scheduled for late February 2012. Preparations are being made for the mission readiness review and flight readiness review. Orbital is conducting Phase 3 in two segments. The company has a lot of testing yet to do. NASA has conducted its analysis to ensure the PCBM interfaces work, and there has been some integrated testing with the entire software suite. Avionics and PCBM testing are continuing. Mr. Suffredini provided status information for the Orbital Demo Cargo, Orb-1, and Orb-2 flights. On the Demo, the pressurized cargo manifest is 704 kg, though reserves might allow that to reach 800 kg if necessary. The Orb-1 launch date of May 11, 2012 may slip. The major milestones have been completed, however. On Orb-2, there will be a new radio vendor, as well as a new vendor for the lidar system.

All but one hazard has been approved for SpaceX, and that remaining hazard is collision, which is the most difficult test. The SpaceX demonstration flight is an integrated flight that is scheduled to launch on November 30 and dock on December 9. Some SpaceX dates are likely to move due to space traffic. The communications frequency had conflicts and was changed. This, the thermal vacuum (TVac) testing, and the integrated testing of the flight software have presented challenges for the company. SpaceX will deliver the software in parts, which could involve more testing, which usually results in changes. Any changes will jeopardize the November launch date.

Both the demonstration cargo and SpX-1 flights are fully loaded with the maximum amount of cargo, 800 kgs in both cases. SpX-2 will have the small deployable **Secondary payloads** that the Department of Defense (DoD) plans to use. Mr. Suffredini showed a flight schedule overview chart with increments, crew rotations, vehicle traffic, berthing dates, and launch schedules. This manifest is extremely tight, but it is also optimistic, in that it is unlikely there will be that much actual traffic.

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In looking at ISS consumables through 2013 with no commercial cargo flights, it is clear that the Space Station can manage well through 2012 with no commercial providers. STS-135 brought consumables sufficient to provide a considerable margin. Crew supplies fall off sharply after January 2013, however, and there are also significant drops in utilization and preventive maintenance supplies at that point. Therefore, the ISS integration for demonstration and CRS missions continues. The requirements and preparations for commercial crew have been defined, and provisions have been made for medical emergencies. NASA has modified the IRD to include docking capabilities and is working with the commercial partners to communicate systems requirements and provide the information necessary to eventually dock on the ISS.

Discussion

Mr. Richard Kohrs, Exploration Committee, asked about the terminology of “dock” and “berth.”

Mr. Suffredini said that the former is being used by the commercial crew personnel. Therefore, NASA developed an international docking standard. The Agency may have to provide the mating half until the commercial providers can do it, but the intent is for the companies to build their own.

Mr. Bohdan Bejmuk, Exploration Committee, wanted to know if NASA had sufficient information *about the interiors* of the commercial vehicles and if the companies know enough about the ISS that they can evaluate the integrated hazards.

Mr. Suffredini said that there is sufficient knowledge in both directions, but NASA does not know as much about the commercial systems as it did about its own. However, NASA defined and verified the design requirements.

Mr. Kohrs asked if NASA has access to contractor failure and verification analysis. It does.

Mr. Robert Sieck, Space Operations Committee, inquired whether NASA involvement in the certification of demo flights is similar to activities related to the Automated Transfer Vehicle (ATV).

Mr. Suffredini confirmed that the same approach was taken.

Mr. Bejmuk advised caution in having Aerojet conduct repairs, due to the techniques employed.

Mr. Suffredini explained that this is not NASA’s responsibility, and that Orbital must meet Federal Aviation Administration (FAA) criteria. FAA will make the determination and NASA will have to accept it. However, NASA and Orbital have a good relationship when it comes to solving problems. The situation will be different with commercial crew, where NASA will be deeply involved.

Mr. Suffredini said that he would convey Mr. Bejmuk’s advice.

Mr. McAlister, Acting Director of Commercial Spaceflight Development at NASA, presented the Commercial Crew Program status. With enactment of the President’s budget requests, funds will be sufficient through the middle of the decade. The objective

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of the commercial crew initiative is to facilitate development of a U.S. commercial crew space transportation capability, with the goal of achieving safe, reliable, and cost-effective access to and from LEO and the ISS. The Commercial Crew Program (CCP) will use a non-traditional acquisition and partnering approach that will provide performance incentives, support cost-effectiveness, and eliminate NASA's dependence on a single provider. The 2010 NASA Authorization Act established commercial crew as the primary means for ISS crew transportation. The real partnering aspects come through in how NASA implements the partnership, including oversight.

CCP has made awards to four different companies: Boeing, Blue Origin, Sierra Nevada Corporation, and SpaceX. Each has a different strategy. There is also an unfunded agreement with United Launch Alliance to certify the launch vehicle for the commercial providers. This could apply to SpaceX and Sierra. Sierra and Blue Origin are looking at the integration safety analysis, which NASA will certify as safe for crew.

CCP had hoped to be able to use Space Act Agreements (SAAs), which were used by CCDEV1 and CCDEV2. However, when mitigations through SAAs broke down, CCP looked at other Federal Acquisition Regulation (FAR)-based instruments. However, industry prefers more integrated solutions. The big issues were requirements and certification. NASA felt that waiting would be unwise, and therefore sought a means of having interactions that could not be done under an SAA. Ms. Patricia Grace Smith of the Commercial Space Committee noted that she understood this was a policy issue. Mr. McAlister explained that it was both a policy and legal issue. CCP told NASA's Office of the General Council (OGC) of its interest in doing verification under SAAs, but the OGC said that this was not an option. The human space flight world is very interactive and requires a steep level of verification that cannot be done under an SAA, in part because of difficulties in giving feedback under an SAA. CCP did not consider changing the objectives, which had been given to the Program by the Administration and which the Office of Management and Budget (OMB) had accepted as a baseline.

The proposed strategy is a firm fixed price contract instrument based on milestones. This will maximize industry retention of intellectual property rights. The strategy will not dictate design solutions but will provide approval, tailoring, and the necessary exceptions or waivers. Payments will be based on milestones, with a fixed government investment, and NASA will have control at the "Certification Requirements" level only.

Industry has some issues with this. First, it is a new, hybrid structure, and the commercial providers already have experience with SAAs and FARs, though they dislike the latter. NASA has begun this dialogue. The next phase, a draft Request for Proposals (RFP), will show the waived FAR elements. CCP has begun communicating this to industry and is answering questions that came in online. Dr. Condon cautioned that DOD has demonstrated that such a strategy does not work well for development, and wondered

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how certain CCP was that industry will take the risk on a firm fixed-price contract. Mr. McAlister said that some of this will be learned through the draft RFP. CCP is trying to model the COTS Program. In addition, DOD's development of External Expendable Launch Vehicles (EELVs) was done under a fixed price contract. Dr. Condon said that the question is whether industry will see a return from operational use, which could determine whether companies make the investment.

The market for human transportation will be modest at first. NASA will set requirements for eight crew rotations per year on four flights. CCP delivered a commercial market assessment to Congress. Mr. Alexander said that NASA has to restrain itself in determining design solutions, and the track record is not good. Industry needs to know whether the relationship is that of a contractor or a partner. Mr. McAlister explained that the requirements document states what NASA wants, not how the Agency wants it, and this has been discussed with industry, which is still providing input. The goal is to have baseline requirements at the end of the year, then obtain more industry feedback.

Design and development will be split, and industry will see the difference in the approach to development. All of the key program attributes are maintained in the new strategy. The ultimate goal is to rejoin Russia and China in getting humans to LEO, and the best way to do this is through the Commercial Crew Program.

Discussion

In answer to a question about the budget, *Mr. McAlister* explained that there is not enough money. For this strategy, CCP believes the \$850 million budget request will put NASA on the right path. If funds are significantly less than that, the United States will not be able to launch a commercial crew in 2016, at which point there are real problems. The United States is committed to the ISS through 2020. If the program slips too much, industry will balk and the risk for the entire program goes up. If there are cuts, even in the early years, the program will need to extend and the risk increases. The overall funding has to be balanced or there will be a gap.

Col. Eileen Collins thanked the presenters and the Commercial Space Committee.

COMMERCIAL SPACE COMMITTEE DELIBERATIONS

The final segment of the Commercial Space Committee meeting was a deliberation of briefings received and discussions that took place during the day.

There was a discussion regarding a replacement needed for Michael Lounge, who sadly passed away last spring.

Mr. Alexander sent out a proposed "Finding" relative to the Commercial Crew program and noted things have been evolving with Commercial Crew.

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Mr. Trafton and Ms. Smith noted a caution regarding the change in CCDEV's program from a Space Act Agreement to a more traditional form of procurement as a means of obtaining services. The modified approach at least does show more flexibility than a fully traditional procurement approach.

Mr. Levin suggested a "parsing out" of the issue....the budget was a problem for CCDEV but the acquisition approach presented by Mr. McAlister appeared reasoned. Is the fear that NASA will dictate a design under a traditional Federal Acquisition Regulation/FAR-based approach? How is the Space Act Agreement so much more flexible than under a FAR procurement?

Mr. Alexander: Under a Space Act agreement, the company would present its best case to address NASA requirements; under a FAR contract, NASA has control.

Mr. Levin: NASA is the biggest customer and as such, why shouldn't NASA be able to state its requirements?

Dr. Harris: If you are taking up government assets, one needs to address the government requirements.

Ms. Smith: There is also a concern about change in personnel. If a key NASA program lead left, there could be a less supportive person who may be more inclined to use a more rigid, more traditional FAR type procurement than present leadership.

Mr. Alexander: Fundamentally, NASA at every point up the decision chain, makes the final decision. Under a Space Act Agreement, there is more of a partnership where NASA works more with the partner to address any emerging issues.

Mr. Levin: I believe that as modified, the FAR-based contract may actually be more protective of the rights of the company.

The meeting was adjourned at 2:45.

Committee Membership

Bretton Alexander, Committee Chair
President, Commercial Spaceflight Federation

John Emond, Executive Secretary
Innovative Partnerships Program/Office of Chief Technologist
NASA Headquarters

Major General Donald Hard
U.S. Air Force (retired), independent consultant

Dr. Bernard Harris
CEO, Vasalius Ventures
Former astronaut, former SPACEHAB executive

Lon Levin, Committee Vice Chair
Co-founder, XM Satellite Radio and other satellite businesses

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